Patent Claims

1. A process to manufacture a fibrous, flat and electronically conducting material made of synthetic fibers, in particular synthetically spun fibers (e.g. acrylic fibers), comprising the steps of

- first fibrillating staple fibers having preferably a specific length;
- forming the fibrillated staple fibers into a continuous web in a paper manufacturing process, preferably by means of an inclined wire wet laid paper machine,

characterized in that,

the web is carbonized/graphitized through heating to obtain electrical conductivity.

2. A process according to claim 1, characterized in that the carbonization takes place at a temperature of greater than 600 °C, preferably greater than 800 °C, and very much preferred greater than 1000 °C.

3. A process according to claim 1 or 2, characterized by an initial first temperature treatment that at least partially softens or melts the fibres.

4. A process according to claim 1 or 2, characterized in that the flat material is fixed in a tenter frame prior to the carbonization process.

5. A process according to one of claims 1 to 4, characterized in that the staple fibers are suspended in a solvent, preferably water, to form a pulp and are then fibrillated.

6. A process according to one of claims 1 to 5, characterized in that the fibers are fibrillated in a refiner.

7. A process according to claim 5, characterized in that the pulp dilution in the refiner is approximately 0.1 to 0.01 %, preferably 0.05 to 0.02%.

8. A process according to one of claims 1 to 7, characterized in that a mixture of fibrillated and non-fibrillated fibers is used.

9. A process according to one of claims 1 to 8, characterized in that the fibrillated fibers are processed into webs with a substance weight typically between 45 to 150g/m^2.

10. A process according to one of claims 1 to 9, characterized in that fibers with a Titer of up to 15 dtex maximum, preferably up to 8 dtex maximum and especially preferred with a Titer of up to 3.0 dtex maximum are used.

11. A process according to one of claims 1 to 10, characterized in that fibers with cut lengths between 4 and 40 mm, preferably between 8 and 12 mm

are used to produce the continuousweb.

12. A process according to one of claims 1 to 11, characterized in that synthetic fibers of at least a first and a second type are used.

13. A process according to claim 12, characterized in that the fibers of a second type contain fractions of at least one noble metal or other additive, e.g. a synthetic additive.

14. A process according to one of claims 3 to 13, characterized in that the continuous web is calendared at least once prior to its carbonization.

15. A process according to claim 14, characterized in that the calendaring is carried out at raised temperatures.

16. A process according to claim 14 or 15, characterized in that the web or material is calendared at least twice prior to the carbonization and such that all of the material is densified in a first calendaring step and at least one of the two opposite paper surfaces is changed into a film-like, porous material by melting the fibrillated fibers in a second calendaring step.

17. A process according to one of claims 14 to 16, characterized in that the heat and pressure are selected such that the calendared micro porous

material has pore sizes of < 5μm, preferably < 2μm.

18. A process according to one of claims 1 to 17, characterized in that synthetic fibers such as acrylic or Aramid fibers are used.

19. A process according to one of claims 1 to 17, characterized in that non-crystalline fibers are used as synthetic fibers.

20. A fibrous, flat and porous material obtained from a process according to one of claims 1 to 19.

21. A material according to claim 20, characterized by a fibrous core (13) and at least one micro porous flat cover layer (15) on one side of the material that is more dense than the fibrous region (13).

22. A material according to claim 20 or 21, characterized in that the surfaces of the material opposite one another are micro porous flat cover layers (15) that are more dense than the fibrous region (13).

23. Non-woven fabric characterized in that the fabric comprises carbonized/graphitized polymeric fibres.

24. Non-woven fabric according to claim 23, characterized in that the fabric consists essentially of carbonized/graphitized polymeric fibres.

25. Non-woven fabric according to claim 23 or 24, characterized in that, the fabric is coated with a catalyst layer.

26. Non-woven fabric according to one of claims 23 to 25, characterized in that, the fabric is micro porous.

27. Non-woven fabric according to one of claims 23 to 26, characterized in that, the fabric has a core having a first porosity and at least one cover layer having a second porosity, said second porosity being less porous than the first porosity.

28. Non-woven fabric according to one of claims 23 to 27, characterized in that, the fabric is made from one single web or layer.

29. Non-woven fabric according to one of claims 23 to 27, characterized in that, such a fabric is made from two or more single webs and laminated to a single web.

30. Fuel cells containing at least two gas diffusion layers separated by an ionically-electrically conducting layer separating wall (PEM membrane), said gas diffusion layers being coated with at least one catalyst,
characterized in that,
each gas diffusion layer is formed at least in part from a material according to one of claims 20

to 22 and a non-woven fabric according to one of claims 22 to 29, respectively.

31. Use of a material obtained according to one of claims 1 to 19 and a non-woven fabric according to one of claims 22 to 29, respectively, as a micro porous support for a membrane, in particular a PEM membrane.